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# JPRS Report

# Nuclear Developments

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## AUSTRALIA

### Prime Minister Refutes Allegations That Uranium Exports Go Into Weapons

*51004302 Sydney THE SYDNEY MORNING HERALD in English 16 Apr 88 p 2*

[Article by Pilita Clark]

[Text] Canberra: The Prime Minister denied yesterday that there was any evidence to support allegations that Australian uranium had been processed to weapons-grade material in contravention of the country's safeguards.

The allegations have come from the left-wing Labor backbencher, Mr Peter Milton, and the Australian Democrat, Senator Norm Sanders, based on documents from the European nuclear agency, Euratom.

Mr Hawke told reporters in Sydney that he had been advised there was no evidence to support the allegations.

"If people have any evidence or any material they want to put before us, that will be examined," he said.

"I've heard Allegations for years and years in this area of uranium, and time after time the allegations have been false.

"That means that I don't get alarmed every time I hear an allegation because the period has been marked by them. That doesn't mean I say we're complacent."

Senator Sanders says the Euratom documents show that Australia's much-vaunted nuclear safeguards are a force that safeguard nothing.

"The documents are confidential minutes of a Euratom advisory agency which was seeking to facilitate 'flag swaps' which relabel Australian uranium so that it appears to originate from other countries which have laxer safeguards," he said.

"The documents show that a number of these swaps have already occurred, some involving South African and Namibian uranium, and that neither Euratom nor the Australian Government can be certain that they do not involve Australian uranium.

"Despite claims to the contrary, there is nothing to prevent Australian uranium ending up in French bombs being tested in the Pacific."

Euratom is the watchdog body that regulates the transport and use of uranium in Europe.

The Minister for Primary Industry and Energy, Mr Kerin, released a letter from the director of the Australian Safeguards Office, Mr Frank Betts, which denied that International Atomic Energy Agency safeguards were deficient.

Mr Kerin will make a detailed statement on the allegations next week.

The ASO's 1986-87 annual report, released this week, says the main method used by the IAEA to check its safeguards program "does not evaluate the probability that undetected diversion might occur or identify the most probable ways in which attempts at diversion would be made."

Mr Bett said this did not mean that the ASO, which monitors Australian uranium subject to bilateral safeguard agreements, believed the IAEA safeguards were deficient.

He said the report was referring to the numerous diversionary paths monitored by the IAEA; that is the number of ways by which uranium could be diverted illegally.

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## HONG KONG

### Nuclear-Accident Contingency Plan Gets Go Ahead

*51400010 Hong Kong HONGKONG STANDARD in English 13 Apr 88 p 2*

[Text] The Executive Council has given the go-ahead to the Government to implement a contingency plan for nuclear accidents.

Nearly all Government departments will get a share in the contingency plan—drawn up by UK consultants—and the Government intends to have the whole scheme ready in a few years.

"There is no hurry to executive the plan as the nuclear plant at Daya Bay will not be in operation until 1992," said a senior Government source.

The recommendations of the Harwell-based United Kingdom Atomic Energy Authority dismissed the need for an evacuation plan as Hongkong is 50 kilometres from the Daya Bay nuclear plant.

The report recommends the monitoring of radiation levels, and the prevention of contamination of food and water supplies in the event of a nuclear accident.

It is left for the Government to work out the details of the sharing of the responsibility among individual departments and their fundings.

"The Secretary for Economic Services Branch, Mrs Anson Chan, will act as coordinator temporarily until a new head is chosen," said the official.

As the contingency plan relates more to security, it is likely the job of coordination may go to the Secretary for Security.

At yesterday's Exco meeting, members were satisfied with the plan by the Harwell consultancy.

Exco also gave the go-ahead to the Government to distribute the report to the public once enough Chinese copies were available.

The Government printer had produced enough English copies but Chinese versions were still being printed.

It is expected the public will be able to read the Harwell report by the end of the month.

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# BULGARIA

## Bulgaria Issues Regulations on Nuclear Safety

**Nuclear and Radiation Safety Information**
*51003003 Sofia DURZHAVEN VESTNIK in Bulgarian 5 Apr 88 pp 4-5*

[Text]

**Committee for the Utilization of Nuclear Energy for Peaceful Purposes of the Council of Ministers**

**Regulation No 2 of 24 November 1987 on Cases and Procedure for Informing the Committee for the Utilization of Nuclear Energy for Peaceful Purposes on Operational Changes, Events and Accidents Related to Nuclear and Radiation Safety**

**Section I**

**Cases Requiring Information**

Article 1. Organizations which control or use nuclear material must inform the Committee for the Utilization of Nuclear Energy for Peaceful Purposes of the Council of Ministers (KIAEMTs) of any operational changes, events and accidents which have occurred and are related to nuclear and radiation safety (subsequently referred to as "safety-related events"), in the following cases:

(1) Violation of technical stipulations and requirements on storing nuclear fuel;

(2) Fire in the premises where fresh nuclear fuel is stored;

(3) A drop in the level of the water in the precipitation basins or storage areas for spent nuclear fuel below the admissible level as indicated in the design or the operational instructions;

(4) Violations of the temperature regimen for the water in the precipitation basins or storage areas for spent nuclear fuel;

(5) Disturbance in the mechanical integrity of heat releasing elements or cassettes;

(6) Violations of the rules governing the safe transportation and technological moving of nuclear materials.

Article 2. Organizations which manage or use a nuclear installation must inform the KIAEMTs on events related to safety in the following cases:

(1) Damages to elements or systems which lead to violations of the configuration of the active zone, the hermetic sealing of the first loop, the sealed premises or elements related to the control and management of the power, reaction and level in the pressure adjuster and pressures and temperatures in the reactor and the first loop;

(2) Failure of the accident-prevention or any other safety system to start or complete its functions as stipulated in the design, regardless of the cause;

(3) Changes in the reactivity of the nuclear system as a result of the appearance of unplanned criticality, unplanned increase of reactivity in a subcritical condition or the noncompensation of the reactivity under different conditions and regimens;

(4) Failure of equipment, wrong actions or omissions by the personnel, which resulted or could result in disturbances of the stipulated functions of the conduits within the safety system.

(5) Other violations of limits and conditions for safe operation, regardless of the reason;

(6) Natural phenomena or other events (earthquakes, sinking of the ground, floods, airplane accidents, fires, explosions, etc.) which result or could result in the breakdown of systems important to safety or else prevent the personnel from performing its functions;

(7) Presence of gas aerosol released within the strict regimen area and outside of it; violations of dose maximums for internal or external radiation of people or animals or pollution of environmental projects above admissible standards;

(8) Impossibility of evaluating the radiation circumstance of a nuclear system or the surrounding area as a result of breakdowns in the technical means of radiation control and lack of back-up facilities;

(9) Actuating the protective shielding (for power reactors, excluding the actuating of the turbine shields);

(10) Manual or automatic actuating of the system for emergency cooling of the first loop (high, average or low pressure), the sprinkler system, the emergency water supply to the main consumers, emergency sources of electric power and other safety systems, excluding cases of testing such systems as scheduled;

(11) Other cases related to the safety of the nuclear installation, as determined by the management of the organization.

Article 3. Organizations which manage or use radioactive substances or other sources of ionizing radiation must inform the KIAEMTs of events related to safety in the following cases:

(1) Loss of radioactive source or certification of the type and activeness of the radioactive isotope;

(2) Improper use of a source of ionizing radiation;

(3) Radiation of people, inhalation, absorption or lasting pollution of the skin or of environmental projects above admissible standards;

(4) Natural catastrophes, industrial accidents and accidents affecting work premises or areas used for the storage of radioactive substances, equipment and apparatus using such substances or transportation facilities for such substances, which create a potential danger of radioactive pollution, uncontrolled dissemination of radioactive substances or excessive radiation of people.

Section II

**Information Procedure**

Article 4. (1) Organizations controlling or using nuclear materials, nuclear installations, radioactive substances or other sources of ionizing radiation must inform the KIAEMTs by telex, telegram or any other telecommunication facility in cases indicated in Chapter 1 no later than 24 hours after their occurrence.

(2) In cases of nuclear or radiation accident the consequences of which could be show up outside the sanitary-protection zone, the information must be provided no later than 1 hour after its occurrence.

(3) In the case of an accident which creates a danger of spreading of radioactive substances beyond the borders of the country, the information must be provided within the time stipulated in Paragraph 2 and include the necessary data as per the Convention on the Operative Information on Nuclear Accidents.

(4) The KIAEMTs will inform the specialized competent control authorities on cases indicated in Chapter 1.

(5) The form of information will be determined by the KIAEMTs and the Ministry of Internal Affairs.

Article 5. (1) In the cases stipulated in Chapter 1, the organizations will submit to the KIAEMTs a written report no later than 30 days after the occurrence of the event.

(2) Should additional data and circumstances related to the event be determined, the organizations shall send a supplementary report within 30 days of their discovery.

Article 6. (1) In exceptional cases involving undetermined data and circumstances of an event, which hinder the drafting of the report as per Article 5, Paragraph 1, the organizations shall submit, within the deadline stipulated in the same paragraph of Article 5, a preliminary report describing all determined and undetermined data and circumstances and the reasons for the lack of determination.

(2) After all data and circumstances of the event have been determined, but no later than the deadline stipulated by the KIAEMTs, a final report will be issued on each specific case.

Article 7. (1) The reports as per Articles 5 and 6 must include sufficient data on the event so that no additional substantial information will have to be submitted.

(2) Copies of all charts, diagrams or tables taken from the recording instruments, and others, must be appended to the reports submitted as per Paragraph 1.

**Section III**

**Responsibility**

Article 8. (1) Responsibilities for failure to inform, or for delayed, inaccurate or incomplete information of events related to safety shall be assumed by the head of the organization or the official entrusted with providing such information.

(2) In cases of appointing an official responsible for providing the information, a copy of the order of his appointment must be addressed to the KIAEMTs, indicating the position, qualifications and work and home address and telephone number of the individual.

Article 9. Individuals guilty of failure to inform or to provide delayed, inaccurate or incomplete information pertaining to events related to safety will be held liable as per Article 42 of the Law on the Utilization of Nuclear Energy for Peaceful Purposes.

**Additional and Concluding Stipulations**

1. The present regulation is issued on the basis of Article 16, Paragraph 2 of the Regulation on the Application of the Law on the Utilization of Nuclear Energy for Peaceful Purposes (DV, No 66, 1986), in connection with Paragraph 1 of said article.

2. The appendix to the regulation will indicate the forms and means of drafting reports as per Paragraphs 5 and 6 of Chapter 2.

Chairman: I. Pandev.

## Nuclear Power Plant Safety

*51003003 Sofia DURZHAVEN VESTNIK in Bulgarian 8 Apr 88 pp 1-11*

**Committee for the Utilization of Nuclear Energy for Peaceful Purposes of the Council of Ministers**

**Regulation No 3 of 24 November 1987 on Ensuring the Safety of Nuclear Power Plants in Designing, Building and Operating**

**Chapter 1**

**General Stipulations**

Article 1. The present regulation pertains to the basic problems of the safety of nuclear power plants (ATs), based on their specific nature as sources of ionizing radiation and radioactive substances.

Article 2. This regulation includes organizational and technical requirements the observance of which is a necessary prerequisite for ensuring the safety of the ATs in terms of their design, building and operation.

Article 3. A nuclear power plant will be considered safe if the technical means and organizational measures ensure that the stipulated doses of internal and external radiation of the personnel and the population and standards governing the content of radioactive substances in the environment with normal operation and planned accidents are not exceeded.

Article 4. The maximally admissible doses of radiation of the personnel, the levels of doses for the population and the standards governing the content of radioactive substances in the environment under normal operations and conceivable accidents will be established in accordance with radiation safety standards.

Article 5. The safety of ATs will be ensured essentially by:

1. Selection of a suitable area for the ATs and its suitable remoteness from large settlements;

2. Determination of the necessary hygiene-safety zone around ATs;

3. Equipping the ATs with safety systems;

4. High quality of design of system and elements important in terms of safety and of the ATs as a whole;

5. High quality of the manufacturing, insulation, repair and reconstruction of equipment and pipelines;

6. High quality of construction and installation work in accordance with blueprints and regulation-technical documents;

7. Maintaining in proper condition the systems and elements important in terms of safety through preventive measures (periodical control over the condition of the equipment, testing its functional condition, repairs) and replacement of worn out equipment;

8. Commissioning and operating ATs in accordance with the requirements of regulatory-technical documentation;

9. Personnel qualifications.

Article 6. (1) The design of the ATs must include technical means and organizational measures which will ensure safety in the case of any one of the initial events included in the design involving a failure, regardless of the initial event, of any one of the following elements of the safety systems: active or passive element with mechanically moving parts.

(2) In addition to the failure of the elements as per Paragraph 1 will be undiscovered failures leading to violations of the limits of safe operation of elements which are not controlled in the operation of the ATs but which influence the development of the accident.

(3) Failures as per Paragraphs 1 and 2 may not be reported in cases of proven high level of reliability of said elements or systems of which they are part or the removal of a work element for a short time for purposes of technical servicing. The level of reliability will be considered high if the indicators of reliability of said elements are no lesser than the indicators of reliability of the safety systems, failures of which are not reported. The admissible time for the removal of an element for purposes of technical servicing will be based on the study of the reliability of the system of which this element is a part.

Article 7. Minimal lists for initial events for ATs will be determined in accordance with the stipulations of the present regulation and will be included in the respective legal documents related to the conditions, procedure and deadlines for issuing permits for the use of nuclear energy. The complete list of the recorded initial events must be coordinated with the state control authorities and discussed in that part of the project entitled "Technical Validation of Safety in Building and Operating ATs."

Article 8. The most severe reported initial events for water-cooled power reactors (of the VVER type) and the reactors of heat-generating nuclear power plants are indicated in Chapter 4.

Article 9. (1) The design must stipulate technical facilities for the prevention of the mass melting of heat-releasing elements in initial events as per Articles 7 and 8.

(2) Requirements governing the efficiency of the safety systems with a view to the admissible breakdown of heat-releasing elements are indicated in Chapter 4.

Article 10. In order to ensure the safety of the personnel and the population in hypothetical accidents of an ATs, planned measures are drafted and carried out on the territory of the industrial site and the surrounding territory.

**Chapter 2**

**Requirements Governing Safety of ATs and Its Systems**

**Section 1**

**General Requirements Concerning ATs**

Article 11. As a source of ionizing radiation and radioactive substances, the ATs must meet the requirements of the present regulation and the standards and regulations governing nuclear, technical and radiation safety of ATs.

Article 12. The design of the ATs must stipulate the safety systems for:

1. Accidental stop of the reactor and maintaining it in a subcritical condition;

2. Emergency release of heat;

3. Keeping radioactive products within the stipulated boundaries.

Article 13. (1) All ATs systems important in terms of safety must meet the stipulations of the present regulation and the standards and regulations governing the building, manufacturing and installation of facilities for nuclear equipment and other regulatory documents pertaining to the safe utilization of nuclear energy.

(2) Inspection control and acceptance by the respective authorities are stipulated in the manufacturing, assembling, repairing or reconstructing equipment and its commissioning.

Article 14. The ATs systems important in terms of safety must be designed, manufactured and installed taking into consideration possible mechanical, thermal, chemical or other influences which may appear as a result of possible emergencies.

Article 15. (1) The ATs systems important in terms of safety must be designed, manufactured and installed taking into consideration natural phenomena typical of the area, such as earthquakes, hurricanes, floods, winds, etc.

(2) The safety systems must be able to perform their stipulated functions under the conditions of natural phenomena stipulated in Paragraph 1.

Article 16. As a rule multiple-purpose use of safety systems and their elements will not be allowed. In individual cases such use may be permitted if the project stipulates that the combination of functions would not violate safety requirements.

Article 17. The use of passive systems is desirable in the installation of safety systems.

Article 18. (1) The ATs systems important in terms of safety must be checked after repairs and submitted to periodical checks throughout their period of operation.

(2) Technical servicing and check-ups must not result in any lowering of the safety level.

Article 19. The design of ATs systems important in terms of safety and in commissioning the system must stipulate the following:

1. Attachments and systems for testing the proper functioning of the systems (including systems within the reactor);

2. Facilities for determining that the systems are consistent with planned indicators;

3. Facilities for testing the sequential transfer of signals and actuating of equipment (including conversion to emergency power);

4. Attachments and facilities for controlling the condition of the base metal and welded seams in the equipment and the pipelines, the breakdown of which may be the initial reasons for an accident;

5. A regulation governing technical servicing and tests.

Article 20. As a rule direct and full investigation for consistency with planned features are conducted of systems and facilities important in terms of safety. Should such a test be impossible, an indirect testing or partial testing is done for the purpose of which corresponding systems and methods must be anticipated.

Article 21. The ATs design must stipulate facilities which would exclude or reduce the consequences of errors committed by the personnel and which could lead to a worsening of consequences resulting from the failure of any given system.

Article 22. (1) ATs designs must contain a quantitative analysis of the indicators of reliability of the systems important in terms of safety.

(2) The extent of the analysis must be defined by the acquired data on the reliability of the equipment and the systems.

Article 23. The technical specifications must include a special part entitled "Technical Validation of the Safety of Building and Operating ATs," drafted by the chief designer. A similar draft for the reactor must be formulated by the chief designer and the scientific manager in charge of safety problems.

Article 24. (1) A program for ensuring the quality of the building and operation of ATs, determining the activities of design, engineering, construction and installation organizations, and the plants which manufacture the equipment and the superior organization and the personnel must be drafted.

(2) In connection with the requirements of Paragraph 1 corresponding regulatory-technical documents must be drafted and approved.

**Section II**

**Design and Features of the Active Zone**

Article 25. (1) In designing the active zone the admissible limits of damage in the course of normal operations must

be determined in advance (quantity and level of damage) for heat releasing elements and related levels of radioactivity of the heat carrier in the first loop.

(2) The active zone and the other systems which determine the conditions of their work must be designed in a way such as to exclude the violation of stipulated limits for damages of heat releasing elements for the duration of the operational time under conditions of normal operations. No exceeding of stipulated limits is permitted for any one of the following violations of normal operations (taking into consideration the operation of the safety systems):

1. Malfunctions in the reactor management and control system;

2. Loss of electric power supply for the main circulation pumps;

3. Cutting off turbogenerators and heat consumers;

4. Total loss of external power supply sources;

5. Leaks in the first loop, compensated by regulation supply systems.

Article 26. The fast reaction power coefficient must not be positive whatever work system is used at the ATs, regardless of the conditions of the system for releasing the heat from the heat carrier in the first loop.

Article 27. The characteristics of the nuclear fuel and the design of the reactor and any other equipment in the first loop, including the system for flushing the heat carrier, combined with the other systems, should be such as to exclude the possibility of developing critical masses in any kind of accident, including accidents which may lead to a destruction of the active zone or the melting of the fuel.

**Section III**

**Systems for Influencing Reactivity**

Article 28. A minimum of two independent systems (two independent organs or two independent groups of organs) must be stipulated for influencing reactivity; it would be desirable to base such systems on different principles.

Article 29. (1) No less than two of the stipulated independent systems for influencing reactivity should be able, independently of the other, to ensure a conversion from any condition of normal operation to a subcritical condition and maintain this condition with the working temperature of the heat carrier and the delay mechanism.

(2) The conversion to a subcritical condition must be quite fast in order to prevent any damaging of heat-releasing elements above the admissible limits in any recorded initial event.

Article 30. (1) At least one of the stipulated independent systems for influencing reactivity should be such as to ensure a conversion from any condition of normal operation to a subcritical condition under all circumstances and also in transitional processes of recorded initial events.

(2) Conversion to a subcritical condition must be quite rapid in order to prevent damages to heat releasing elements above the admissible levels in any recorded initial event in accordance with the principle of the isolated breakdown of a given system, including failure to activate one of the most effective systems for influencing reactivity.

(3) The division of the full range of changes in reactivity within the indicated transitional processes into several temperature and regimen ranges is allowed; for each range part of the stipulated system may be used (part of the organs or groups of organs) and the principle of isolated failure of any part of the system must apply.

Article 31. No less than one of the stipulated independent systems for influencing reactivity must ensure a conversion from any condition of normal operation to a subcritical condition and maintain this condition, taking into consideration a possible release of reactivity in extensive cooling under all normal conditions and recorded initial events, in accordance with the principle of the isolated failure of a given system and the failure to activate one of the most efficient systems for influencing reactivity.

Article 32. The system for influencing reactivity and the features of the active zone must be such as to ensure the absence of fast suppression under normal operation of fluctuations in the power and distribution of energy release as a result of which during the time of the campaign in the active zone a heat releasing element may be damaged beyond the limits stipulated for normal operations.

Article 33. The system for influencing reactivity in the case of an isolated disturbance in the control and management system should be such as to ensure a suppression of positive reactivity related to the removal of parts affecting reactivity (within the limits of planned speed) without damaging heat releasing elements above normal operational ranges.

Article 34. The maximal efficiency of the parts influencing reactivity and the maximally possible speed of growth of reactivity in cases of mistaken action by the personnel or isolated violation of any system within the ATs should be limited in such a way that the effect of the subsequent power increase may not result in:

(1) Surpassing maximally admissible pressure in the first loop;

(2) Inadmissible worsening of the efficiency of heat release or melting of heat releasing elements.

Section IV

**First Loop System**

Article 35. The entire equipment and the pipes of the first loop must be able to withstand without damage any statistical and dynamic loads and temperature influences which may appear in any one of its assemblies and components (taking into consideration the effect of shielding systems and their possible failure as per Article 6), in the case of unplanned release of energy in the heat carrier of the first loop, caused by:

(1) Sudden triggering of reactivity in the ejection at maximal speed of a part affecting reactivity with a maximal efficiency, if such an ejection is not prevented by the structure;

(2) Introducing a cold heat carrier in the active zone (with a negative temperature coefficient of reactivity of the heat carrier);

(3) Drastic reduction in the outlay of the heat carrier with subsequent increase of reactivity;

(4) Any recorded initial events leading to disturbances of heat release in the first loop.

Section V

**Control and Management System**

Article 36. The ATs must have a block control panel from which the reactor and the other ATs systems are controlled and directed under normal operational conditions, in violations of normal operations and in cases of breakdown.

Article 37. The ATs control and management system must control and record the parameters which characterize the work of the power plant in all possible ranges of their changes and for automated or remote control of systems for normal operation under all possible regimens. The control and recording means must be such as to offer the possibility of determining subsequently the sequence in the appearance and development of the accident and the actions of the personnel.

Article 38. The ATs must have facilities for control and management of the process of the splitting of the nuclear fuel under all possible systems and conditions prevailing in the active zone (including replacement of the fuel) whenever the possibility of a conversion to a critical condition exists.

Article 39. The ATs must have indicators of the situation of the parts influencing reactivity, control of the concentration of the soluble absorber of neutrons and indicators of the condition of the other means which influence reactivity.

Article 40. The design must include a study of the diagrams of the reactor control systems and the ATs for possible dangerous reactions of the systems, which may result in violations of safe exploitation in case of circuit faults (electric shorts, worsening the quality of insulation, drop and disturbances in the tension, etc.). Before the reactor has been started, the systems must be tested for dangerous and misleading reactions.

Article 41. The possibility of detecting any leakage of the heat carrier in the first loop must be contemplated for the ATs.

Article 42. The ATs must have a control (automatic if possible) of the radioactivity of the heat carrier (for the basic radionucleides) and radioactive waste at the places of their organized separation, as well as control of the radiation situation in serviced and nonserviced premises and their surroundings.

Article 43. The ATs must have facilities (automatic if possible) to control the conditions for storing the fuel and radioactive waste and a signaling system indicating violations of safety conditions.

Section VI

**Safety Systems Control**

Article 44. (1) The ATs must have safety control systems which would perform the function of automatically actuating the systems of protective, localizing and support systems and control over their function.

(2) The automated control systems (which include electric, hydraulic, mechanical and other systems and circuits) must, through the shielding systems, prevent or correct conditions which lead to damaging heat releasing elements above the planned levels.

Article 45. The actuating of the parts of the systems which influence reactivity must not depend on the availability of external power sources.

Article 46. The reliability of control systems must be ensured through:

(1) Corresponding requirements concerning the quality of manufacturing;

(2) The duplication of systems;

(3) Checks and tests of the elements and systems in operation;

(4) The availability of uninterrupted power supply.

Article 47. Any damage to control systems should lead to the appearance of a signal on the control panel and trigger activities aimed at ensuring the safety of the ATs.

Article 48. (1) The duplication of the systems and the independence of their channels must be such that any isolated failure of the control system (including failures due to general reasons) will not violate the systems' ability to function.

(2) The duplication of channels presumes the existence of no less than two independent channels. In order to achieve total independence of the channels it is desirable that different principles be applied (use of different parameters for activating the systems, use of different detectors, etc.)

Article 49. The safety control systems must be separated from the control and management systems to such an extent that the disturbance or removal of any given element or channel within the control and management system may not influence the ability of the safety control system to perform its function of ensuring safety.

Article 50. The ATs must have the possibility of manually actuating safety systems. Any damages in the automatic actuating circuit must not be able to hinder the manual actuating and performance of the safety function. A single element (key or switch) should suffice for manual activating.

Article 51. The safety control systems must be designed in such a way that any initiated action may lead to the full implementation of the function. The return to initial conditions must require sequential actions on the part of the operator. The structure of the control systems must be such as to reduce to a minimum the possibility of false actuating.

Article 52. The ATs must have facilities for testing the functionality of the individual channels and control systems as a whole in the course of operating the reactor. The control panel must steadily provide corresponding information on any loss of capability of implementing its functions by any part of the control system.

Article 53. The ATs must be provided with the possibility of actuating safety systems and obtaining information on the condition of the reactor at a spare control panel, should for any reason (fire, etc.) this may prove to be impossible with the block control panel.

## Section VII

### Safety Protection Systems

Article 54. The safety protection systems must perform their functions of securing safety in any conceivable initial events and failures independent of the initial event, in accordance with Article 6.

Article 55. (1) The set of protective systems must include a system for emergency release of the heat from the reactor, consisting of several independent channels and providing the required efficiency with a failure, independent of the initial event, of any one channel within this system.

(2) The systems (channels) for cooling under normal exploitation may be used as systems (channels) for emergency release of the heat from the reactor providing that they meet the requirements stipulated for safety systems.

Article 56. The ATs must have facilities which would prevent the reaching of a critical mass of the reactor in actuating the systems of emergency release of heat generated by the reactor.

Article 57. The actuating of the safety protection systems must not lead to damages caused to the equipment in the systems for normal operation. The design must validate the admissible number of actuated safety protection systems for the entire operational life of the ATs (including false actuating) from the viewpoint of the influence on the work capacity of the equipment.

## Section VIII

### Localizing Safety Systems

Article 58. The ATs must have localizing systems for holding within the boundaries stipulated by the design any radioactive substances which have been released outside the limits of the reactor as a result of a breakdown.

Article 59. The first loop must be located in hermetically sealed premises either entirely or in such a way that in case of breakdowns the released radioactive substances may be localized within the boundaries of the hermetically sealed premises. In isolated cases a deliberate release of radioactive substances in the environment is admissible if so validated in the design so that such a release will ensure the safety of the ATs.

Article 60. (1) The localizing systems must perform their functions in full in recorded initial events and in failures independent of the initial event, in accordance with Article 6.

(2) For ATs consisting of several blocks, individual localizing systems for each block must be contemplated.

(3) The combined use of individual facilities of localizing systems for several blocks is allowed providing that the impossibility of the spreading of the accident from one block to another has been proved.

Article 61. The localizing systems must perform their functions in breakdown leaking of the heat carrier in the first loop, taking into consideration possible mechanical, heat and chemical influences.

Article 62. In cases in which active heat release is contemplated to prevent any increase in the pressure in the hermetically sealed premises, the corresponding system must have several independent channels which would provide the required efficiency independently of the initial condition of failure of any one of them.

Article 63. (1) No less than two insulating parts, located on the outside and inside the sealed loop must be mounted on each pipeline crossing sealed partitions, which must be removed in case of accident in order to prevent the leaking of radioactive substances outside the areas of hermetically sealed premises.

(2) No less than one insulating valve located outside the sealed loop must be mounted on each pipeline which is not directly connected to the first loop or to the hermetically sealed premises.

Article 64. The ATs must have facilities for individual testing of the computed pressure, and requirements governing such tests must be drafted.

Article 65. The design must include a validated admissible level of leakage of the sealed loop for the localizing systems; means of achieving the stipulated degree of hermetic sealing must be indicated. The consistency between the level of sealing and the design level must be confirmed after the completion of the construction and installation work and tested regularly in the course of operations. The tests in the course of commissioning the facility must take place under computed pressure and subsequent tests can be conducted at a lower pressure. The equipment located in the premises of localizing systems much be able to withstand the tests without being damaged.

**Section IX**

### Safety Support Systems

Article 66. The ATs must have support systems which will perform the functions of supplying the safety systems with an operational environment and power and create conditions for their functioning under emergency conditions.

Article 67. The support systems should be able to perform their functions regardless of the initial event as per Article 6.

**Section X**

### Systems for Storing Fuel and Radioactive Waste at Nuclear Power Plants

Article 68. The possibility that a critical mass may be reached in the storage areas of fresh or spent fuel while stored or moved must be physically excluded by providing suitable features to the equipment in the storage areas, above all with the help of geometric factors and planned structural layouts.

Article 69. The storage areas for spent fuel must include reliable systems for the release of residual heat and a proper chemical composition of the heat releasing environment to prevent the damaging of the fuel as a result of which radioactive substances could leak into the premises of ATs or the environment.

Article 70. (1) The design of ATs must include a study of the composition and quantity of solid, liquid and gaseous radioact...e waste under normal as well as emergency conditions.

(2) Facilities for processing and areas and means of temporary and long-term storing of waste must be stipulated for nuclear power plants, leading to the systems for their treatment before releasing into the air and the atmosphere, the water discarded by the plant in natural water reservoirs, and means for the transportation of waste within the ATs and to the areas where it will be buried.

**Chapter 3**

## Ensuring Operational ATs Safety

**Section I**

### Organizational Requirements and Operational Documentation

Article 71. (1) The technological regulation, which includes the rules and basic methods for the safe running of the power plant, the general procedure for the conduct of operations related to the security of ATs and the limits and conditions ensuring safe use is the basic document pertaining to the safe operation of ATs.

(2) The technological regulation must be drafted by the managing organization. The regulation must be coordinated with the scientific manager, chief builder and chief designer.

Article 72. (1) On the basis of the technological regulation, the ATs management will ensure the prompt drafting of operational instructions.

(2) The instructions on operating the equipment and the systems must include specific stipulations for the operational personnel on the means of work under normal operational conditions of ATs and regulate the actions of the personnel in cases of breakdowns and failures of ATs equipment and systems.

Article 73. On the basis of the documents stipulated in Article 23 and the technological regulation, the ATs management will organize the drafting and publication of internal instructions which will govern the activities of the operational personnel in ensuring safety in all envisaged initial events.

Article 74. The ATs management will organize the drafting and publication of the following documentation of safety systems:

(1) Schedules for planned preventive and capital repairs of individual structures, elements and systems;

(2) Schedules for testing and checking the functioning of the power plant systems;

(3) Internal instructions for carrying out the stipulated work in accordance with the requirements of the technological regulation;

(4) Other operational documentation.

Article 75. Documents related to designing and building ATs and all documents related to the safety of the power plant must be kept in the ATs for the entire period of operations and, after that, until the ATs has been totally decommissioned.

Article 76. The ATs must keep operational technical documents in accordance with the present regulation as well as other legal documents pertaining to the use of nuclear energy.

Article 77. The readings of the recording instruments with which the limits and conditions of safe operation are controlled must be of high quality and kept for the duration of two refueling periods or for a 2-year period, other than records pertaining to failures and accidents. Such records must be added to the materials on investigations of refusals and accidents and kept together with them for the entire operational life of ATs.

Article 78. The destruction of records must be based on an order which will include an additional short list of violations of normal operations and a reference to the legal documents on the investigation of accidents.

**Section II**

**Requirements Concerning Operational Personnel**

Article 79. (1) The operational personnel must have been hired prior to the commissioning of the ATs. The hiring, training and certification of the operational personnel must take place in accordance with the schedule on the basis of programs approved by the superior organization and in accordance with other legal documents pertaining to the use of atomic energy.

(2) In training and retraining the personnel particular attention must be paid to their activities in emergency situations.

**Section III**

**Commissioning for Service**

Article 80. (1) The following must be done for permanent commissioning for service:

1. A check of the consistency between the building of the ATs and the design;

2. Starting-tuning operations must be carried out (including tests of individual systems and equipment);

3. Comprehensive tests of ATs (including the physical and power starting of the reactor).

(2) The commissioning of the ATs must be based on a procedure stipulated in the respective legal documents and the present regulation.

Article 81. The ATs block the construction of which has been completed and which is to be commissioned must be isolated from the areas in which construction work is still under way in such a way that such work and possible disturbances in construction sectors will not affect the security of the block and, regardless of any possible violations and breakdowns in the operating block, the security of the block under construction will remain secured.

Article 82. The documents which deal with starting and tuning-up operations also must include the list of operations which may be potentially threatening to safety (such as operations which may lead to an uncontrolled development of a supercritical condition in the active zone) and a list of accident-prevention steps.

Article 83. Permission for physical and power start-up will be issued after the state control authorities have issued their own permission and agreement.

Article 84. In the power start-up of the ATs to a level of power lower than nominal, permission for the further start-up to the level of the nominal capacity will be

issued by the state control authorities on the request of the superior organization, coordinated with the scientific manager, chief builder and chief designer.

Article 85. The functioning of the ATs will be allowed on the basis of the acceptance protocol issued by the state acceptance commission based on the existence of the corresponding documentation issued by the state control authorities and in accordance with legal-technical documentation.

**Section IV**

### Operational Safety

Article 86. The normal functioning and admissible deviations from it must be stipulated in the operational instructions drafted on the basis of the design-technical documentation and the technological regulation and amended on the basis of the physical and power start-up.

Article 87. The work of the reactor must be stopped if as a result of damages in the systems, important in terms of safety, and the limits and conditions for safe operation, stipulated for the ATs cannot be observed, regardless of the level of power of the reactor which may have been reached.

**Section V**

### Radiation Safety of the Personnel and the Population in the Course of Operations

Article 88. The radiation safety of a functioning ATs must be based on the present regulation and the other legal documents pertaining to the safe use of nuclear energy.

Article 89. The basic organizational principle will include the strict observance of the regimen of the stipulated zones and control over the crossing of their boundaries by people or radioactive materials being transported.

Article 90. The ATs must have radiation control of radioactive substances released in the air and water reservoirs and for personnel and transportation vehicles which leave the boundaries of the ATs.

Article 91. The ATs must measure the direction and velocity of the wind and other meteorological parameters related to assessing and forecasting the radiation situation in the environment in a normally functioning ATs and in emergency cases.

Article 92. Radiation dosimetric control must be organized in the ATs and the surrounding area, the extent of which must be determined on the basis of legal documents pertaining to radiation safety.

Article 93. Within the ATs the volume, movement and location of all fissionable and radioactive materials must be recorded, including fresh and spent fuel, dismantled radioactive equipment, polluted instruments, clothing and production waste and other sources of ionizing radiation.

**Section VI**

### Planning of Emergency Measures

Article 94. (1) The ATs operational personnel must be mandatorily trained to act in emergency situations.

(2) The actions of the operational personnel in emergency situations must be based on operational and official instructions and special instructions pertaining to accidents.

Article 95. Periodical training based on internal instructions must be provided for the personnel for acting under emergency circumstances. Special simulators must be used for the purpose. Steps must be taken in the course of the training which would exclude the possibility of triggering an emergency situation, including as a result of erroneous actions by the personnel. The study of the actions of the operational personnel must be based on the results of the exercise.

Article 96. Nuclear and radiation accidents occurring in ATs must be investigated by commissions appointed by the superior authorities in accordance with the law. The results of the investigation of an accident and the conclusions and recommendations, approved by the superior organization, must be submitted to the state control authorities.

Article 97. (1) On the basis of the initial data, drafted jointly by the scientific manager, chief designer of the reactor and chief engineer, the ATs management must draft a plan for steps to be taken on the site of the industrial area in the case of hypothetical accidents, coordinated with the state control authorities and approved in accordance with regulations, before the ATs has been commissioned.

(2) The plan-measures must stipulate the coordination of actions by the operational personnel and the external organizations (local authorities, fire prevention, the militia, medical institutions, civil defense authorities and other required organizations).

(3) The plan-measures must indicate precisely who and under what circumstances will inform the external organizations of the start of implementation of the plan; the necessary equipment and facilities for the implementation of the plan and the person in charge of procuring them must be stipulated.

(4) The plan-measures must be periodically reviewed and used as a basis for training exercises.

Section VII

### Periodical Investigations and Inspections

Article 98. Prior to commissioning and periodically, in accordance with the stipulations of the regulations, standards and instructions governing the ATs, the normal functioning of the safety systems must be checked; the condition of the base metal and welds in the equipment and the pipelines must be supervised; the measuring devices with the help of which the limits of safe operation are established must be tested.

Article 99. The frequency and the extent of periodical tests must be stipulated in the technical design. They must be consistent with the corresponding regulatory documents and depend on the role which the control systems or their elements perform in ensuring ATs safety, taking into consideration available information on the reliability of the systems.

Article 100. Extraordinary investigations may be conducted by request of the state control authorities.

Section VIII

### Repairs

Article 101. Repairs of equipment which has been activated and polluted with radioactive substances must take place after the taking of measures to lower the radiation to which the repair personnel is exposed, in accordance with the regulations of the corresponding standards and technical documentation.

Article 102. In repairing equipment which affects the reactivity of the reactor, the nuclear safety and control over the condition of the reactor must be secured.

Article 103. The safety of the ATs must not be endangered by removing equipment for repairs or carrying out repair operations and reactivating.

Article 104. After completion of repair operations the equipment and systems which affect the safety of the ATs must be tested for functionality and in accordance with the design stipulations, and forms on the work done and the results of investigations must be filled.

Section IX

### Decommissioning a Nuclear Power Plant

Article 105. The withdrawal of AETs from service must be considered in the course of the designing and building stages and in the operation, repair and updating of ATs.

Article 106. No later than 5 years prior to the end of the planned operational time the superior organization must draft a project for the organization of the work related to decommissioning the block, coordinated with the state control authorities.

Article 107. Such withdrawal from service must be preceded by a comprehensive investigation by a commission, with the participation of the state control authorities, of the condition of the equipment and pipelines of systems deemed important in terms of safety.

Article 108. The decision to decommission the ATs must be based on the materials of the comprehensive investigation in accordance with stipulated procedures.

Chapter 4

## Additional Stipulations Relative to the Safety of ATs Using Various Types of Reactors and Serving Different Purposes

Section I

### AETs With Water-Cooled Power Reactors

Article 109. The design will rate as maximal any anticipated accident with loss of hermetic sealing of the first loop the sudden break of a pipeline with a maximal diameter of unrestrained bilateral draining of the heat carrier, with a reactor working at nominal capacity, taking into consideration a possible power surge as a result of errors and omissions in the control and management system.

Article 110. The projected limit of damages of heat releasing elements under nominal operations, determining the admissible level of activeness of the heat carrier in the first loop, based on the quantity and size of defects will be (first projected limit of damage of heat releasing element):

(1) One percent of heat releasing elements with noncondensed gas;

(2) 0.1 percent of heat releasing elements with direct contact between the heat carrier and the nuclear fuel.

Article 111. In the unsealing of the first loop the system of emergency cooling must ensure (second planned limit of damage to heat releasing elements):

(1) The temperature of the lining of the heat carrying elements must not exceed 1,200 degrees centigrade;

(2) The local extent of oxidation of the lining of heat releasing elements must not exceed 18 percent of the initial thickness of the wall;

(3) The part of the reactive zirconium must not exceed 1 percent of its mass in the active zone.

Article 112. The design must include a consideration of possibility of removing the active zone after a maximal anticipated accident in an unsealed first loop.

Section II

### Nuclear Power Plants for Heat Supply and Nuclear Thermoelectric Power Plants

Article 113. (1) Nuclear power plants for heat supply (ATsT) may be located at distances no closer than 2 km from the projected city limit of large cities providing that the additional safety requirements as stipulated in Section III have been met.

(2) The future limits of the city in accordance with the approved plan for its development will be accepted in the approval of the site. The further development of the city must be based on the existence of the ATsT and its operational life span.

Article 114. The following limits of radiation of the urban population may not be exceeded in the location of the ATsT:

1. With normal operation of the power plant the maximum individual radiation dose for the population must not exceed 0.2 mSv/y., regardless of the radiation of the thyroid gland and other critical organs and 0.6 mSv/y. for the thyroid gland of a child; the combined dose must not exceed 100 man Sv/y. for the entire surrounding population;

2. With a maximal planned accident the individual radiation dose outside the limits of the power plant must not exceed 0.1 Sv, excluding the radiation of the thyroid gland and other critical organs, and 0.3 Sv for the thyroid gland of a child; the total dose of radiation of the population in the city must not exceed 1,000 man Sv under the worst possible meteorological conditions.

Article 115. Nuclear thermoelectric plants (ATETs) the reactors of which meet the requirements of the present regulation and the technical characteristics of which meet the requirements of Article 114 may be used as a source of heat supply. Such ATETs may be located in the area of the large settlements at a distance from the projected limit of the development of the city, no closer than the following correlation based on the size of the urban population:

### Distance From ATETs to Future City Limits, Kilometers:

Population of 100,000 and over, 10; 300,000 and over, 12; 500,000 and over, 18; 1-2 million, 25.

Article 116. All nuclear sources of heat supply must meet the stipulations indicated in Section IV, which would exclude the penetration of radioactive substances into the heat-carrying grid for heat consumers.

Section III

### Additional Safety Stipulations Relative to ATsT

Article 117. Steps planned for the ATsT must be such as to prevent the melting of the heat releasing elements in the active zone of the reactor in case of damages of any contained in the reactor, leading to its unsealing within the limits of the possible size determined by the technical principles governing the structure of this container. The impossibility of greater amounts of unsealing must be proven.

Article 118. (1) Equipment and systems of the power plant must be located and designed by taking into consideration external influences caused by an eventual crash of an airplane or explosion in a neighboring enterprise, a transportation vehicle, etc. The levels of population radiation stipulated for a maximal projected accident may not be exceeded.

(2) The computed parameters of a crashing airplane are the following: mass, 20 tons; drop velocity, 700 km per hour; impact area, a circle of 7 square meters. The fuel in the airplane may ignite with the crash.

(3) The computed parameters of a shock wave are a pressure of no more than 0.05 MPa and duration of effect no more than 10 seconds.

(4) The impact of a shock wave or a crashing airplane should not lead to the destruction or loss of operational ability of a minimum of one channel in the protective systems and one barrier or channel of the systems for localizing the accident.

Article 119. The design must include the accepted degree of unsealed extent of the localizing system and a proven impossibility of exceeding it. The correlation between the level of sealing and the level stipulated in the design should be confirmed after the development of the system and tested regularly in the course of the operation of the plant.

Article 120. The ATsT must have facilities for removing from the plant's territory liquid and solid waste with different levels of radioactivity and their provisional storage (no more than 5 years) on its territory. The processing of the waste on the territory of the power plant after it has become solidified is allowed.

Article 121. The technological systems for processing liquid radioactive waste must provide for their treatment to a level admissible for reuse of the water for industrial purposes. The overall annual activeness of the discarded unbalanced water must be determined for each separate power plant in drafting the technical blueprint.

Article 122. The technology for the manufacturing of heat releasing elements and their operational conditions must be such as not to exceed the stipulated damage limits (0.1 percent with a loss of sealing of 0.01 percent with contact between the heat carrier and the core of heat releasing elements of pressed uranium dioxide) or an equivalent release of radioactive products in the loop in the case of other types of heat releasing elements.

**Section IV**

**Stipulations Relative to the Protection of the Grid Heat Carrier From Radioactive Products**

Article 123. The system for warming up the grid heat carrier must be such as to exclude the possibility of its pollution with radioactive products, which can be achieved, as a minimum, as follows:

1. The heat of the reactor heat carrier must be transferred through sealed heat transmission surfaces to the intermediary heat environment;

2. The warming up of the grid heat carrier in the heating environment must take place with the help of heat transmitting surfaces;

3. The pressure of the heated environment must be lower than the pressure of the grid heat carrier.

Article 124. Under normal conditions and cases of disturbance of the normal operation, the radioactivity of the heating environment must not exceed the limits determined by the concentration of radionucleides within it in excess of 10 DKB for the water, in accordance with standard documentation related to radiation safety.

Article 125. The heat carrying grid must be disconnected from the heat exchange in the heating environment in the case of an accidental penetration of radioactive substances into the grid heat carrier, which could result in the simultaneous excess of the two maximal values of radionucleides contained within it—0.1 DKB for water and a tenfold increase in the level of activeness of the water supply source.

Article 126. The heat exchanges for warming up the grid heat carrier must be located on the territory of the power plant.

**Additional Stipulations**

No 1. The terms used in this regulation are defined as follows:

1. "Nuclear power plant (ATs)" is a nuclear reactor or reactors with a set of systems, structures, equipment and facilities used for the safe generating of heat or electric power;

2. "Nuclear electric power plant (AETs)" is a nuclear power plant used for generating electric power;

3. "Nuclear thermoelectric power plant (ATETs)" is a nuclear power plant used for generating heat and electric power;

4. "Nuclear power plant for heat supply (ATsT)" is a nuclear power plant the purpose of which is to produce hot water for residential use;

5. "Nuclear power plant for industrial heat supply" is a nuclear power plant which generates hot water and steam for industrial and residential use;

6. "Safety of ATs" is based on ST SIV 4334-83;

7. "Nuclear safety of ATs" is a quality of ATs which excludes, through technical means and organizational measures, the possibility of a nuclear accident;

8. "System" means the sum total of elements (structures, equipment, etc.) which perform specific functions;

9. "Independent systems (elements)" are systems (elements) in which the failure of one system (element) does not result in the failure of another system (element);

10. "The channel of the system" is part of a system which performs the functions of the system to a limited extent;

11. "Systems for normal operation" are systems the purpose of which is to make normal operations possible;

12. "Safety systems" are systems the purpose of which is to prevent accidents and to limit their consequences. The safety systems may be subdivided functionally into protective, localizing, securing and controlling;

13. "Systems important for security" are systems for normal operation, the damaging or failure of which are the starting events for accidents, and safety systems;

14. "Protective safety systems" are systems the purpose of which is to prevent or limit damage to the nuclear fuel and the lining of the heat releasing elements in the first loop and to prevent a nuclear accident;

15. "Localizing safety systems" are systems the purpose of which is to prevent or to limit the spreading within the ATs and falling in the environment of radioactive matter which is released in the case of accidents;

16. "Safety support systems" are systems the purpose of which is to supply power and a working environment for the safety systems and to create conditions for their functioning;

17. "Controlling safety systems" are systems the purpose of which is to activate the safety systems so that they may control and manage the process of the implementation of specific functions;

18. "Control and management systems" are systems the purpose of which is to control and manage the systems for normal operations;

19. "Active system (element)" is a system (element) the functioning of which depends on the normal work of another system (such as the managing system, the source of power, etc.);

20. A "passive system (element)" is a system (element) the functioning of which does not depend on the normal work of any system (such as a control system, source of power, etc.). Based on their structural features, the passive systems may be classified into passive systems with mechanically moving parts (such as back-pressure valves) and passive systems without mechanically moving parts (pipelines, containers);

21. "Normal operation of ATs" means any condition of the ATs consistent with the designed technology for the generating of electric power, including operations at certain levels of capacity, processes in starting and stopping, technical servicing, repairs, and nuclear refueling;

22. "Safe operation limits" are values stipulated in standardizing technical documents for parameters and characteristics, the deviation from which could lead to an increased radiation of the personnel of ATs or the population or else the pollution of the environment with radioactive matters over and above the stipulated values for normal exploitation or causing damages to heat releasing elements;

23. "Conditions for safe operation" are conditions regulating the quantity and status of working systems for normal operation and safety systems based on the regulation on technical servicing and repairs required for purposes of maintaining safety;

24. "Planned limits" are quantitative values of the parameters and features governing the condition of the equipment, based on normal operations and corresponding initial events as anticipated in the design;

25. "Safety criteria" are quality features or values of parameters and characteristics indicated in the standardizing-technical documents or else included in the design, on the basis of which the safety of the ATs is secured;

26. The "principle of single failure" is a principle according to which the system should perform its functions whatever initial event required in its work may occur and with a failure of any one of its elements regardless of the initial event;

27. "Failure for general reason" is a failure of several systems (elements) important in terms of safety, caused by an internal or external influence. "Internal influences" are those which appear as a result of an initial event or accident, including shock waves, reaction flows, flying objects, changes in the parameters of the environment (pressure, temperature, chemical activity, etc.), fires, and others. "External influences" are natural phenomena and human activities characteristic of the ATs site, including earthquakes, high or low level of ground or surface waters, hurricanes, and accidents of air, water or land transportation vehicles;

28. "Undiscovered failure" is a failure of a system (element) which does not appear at the time it occurs under normal operational conditions and is not recorded by the required control facilities in accordance with the regulation on technical servicing and investigations;

29. "Erroneous action by the operator" means an unintentional wrong isolated action by the personnel in the course of implementation of their obligation;

30. "Initial event" is an isolated failure of a system, external event or erroneous action by the personnel, which leads to a violation of the normal operations and which could cause violations of parameters or conditions governing safe operations. The initial event may include any related failures as its consequence;

31. "Radiation accident" is based on ST SIV 4334-83;

32. "Nuclear accident" is an accident related to damages to heat releasing elements or a potentially dangerous radiation of the personnel, triggered by the following:

a. Disturbances in the control and management of the chain reaction of fission in the active zone of the reactor;

b. Forming a critical mass in refueling, transportation and storage of heat releasing elements;

c. Disturbances in the release of heat from the heat releasing elements.

33. "Anticipated accident" is based on ST SIV 4334-83;

34. "Maximal anticipated accident" is an anticipated accident with the worst initial event for all type reactors;

35. A "hypothetical accident" is an accident for which the design does not stipulate technical steps for ensuring the safety of the ATs;

36. "Maximal hypothetical accident" is a hypothetical accident which may cause maximally possible release of radioactive substances in the environment in the melting of heat releasing elements and destruction of localizing systems;

37. The "consequence of accident" is an accident characterized by radiation influence on the personnel, the population and the environment;

38. "Superior organization" is an organization whose system includes the enterprise managing the ATs;

39. "Operational capability," "damage" and "failure" are based on ST SIV 292-76;

40. "State control authorities" are competent state and specialized authorities which supervise nuclear power plants;

41. "Technical safety" is a quality of ATs achieved through technical means and organizational measures, characterized by the durability of the equipment and the pipes the damaging of which could lead to disturbances in the release of heat from the active zone of the reactor, as well as a quality characterized by the ability to keep within the sealed part of the ATs radioactive substances released as a result of failures.

No 2. Violators of this regulation will be held liable as per Articles 40 and 42 of the Law on the Utilization of Nuclear Power for Peaceful Purposes.

**Provisional and Concluding Stipulations**

No 3. The present regulation is issued on the basis of Article 13, Point 3, of the Law on the Utilization of Nuclear Energy for Peaceful Purposes.

No 4. The present regulation applies to all ministries and other departments and organizations engaged in designing, developing and manufacturing equipment, construction and commissioning, operating or closing down nuclear power plants.

No 5. The present regulation may be used as a basis for designing and operating research reactors.

No 6. Deadlines and extent of making nuclear power plants under construction consistent with the present regulation will be issued for each specific case by the Committee on the Utilization of Nuclear Energy for Peaceful Purposes.

No 7. In the case of activities as per No 4 assigned by contract to a foreign organization, the management of the superior organization will ensure the consistency between the work accomplished and the stipulations of this regulation.

No 8. Responsibility for implementation and supervision over the observance of the stipulations of this regulation is assigned to the respective managements of ministries, other departments, organizations and individuals engaged in activities as per No 4.

No 9. Instructions and interpretations on the application of this regulation will be issued by the chairman of the Committee for the Utilization of Nuclear Energy for Peaceful Purposes.

Chairman: I. Pandev

05003

# ARGENTINA

## Alternatives Carried Out by CNEA's Cordoba Complex to Produce $UO_2$

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[Article by Engineer Rafael Coppa and Hugo Martin: "$UO_2$: Production Based on Two Alternative Lines"]

[Text] Introduction

Argentina is one of the few nonindustrialized countries that has the capacity to design and produce nuclear fuels on an industrial scale as well as to plan and build the necessary factory installations. This has been one of the basic objectives of the Argentine Nuclear Plan because, without that capacity, the country would depend on imports in order to get its supply of nuclear fuel and since energy dependence in the 20th century is a serious strategic weakness which affects sovereignty.

National self-sufficiency in the matter of nuclear fuels is the result of 3 decades of work not only in an effort to perfect the industrial technology but also to pursue an effort in physics, metallurgy, and the prospecting and operation of uranium deposits.

With the production of $UO_2$, as described here, we have completed, at the industrial level, total mastery of the nuclear fuel cycle in Argentina and we also have the capacity to produce it in the country.

**The Cordoba Factory Complex of the National Atomic Energy Commission**

The CFC [Cordoba Factory Complex] of the CNEA [National Atomic Energy Commission] is located in Alta Cordoba, in the city by the same name, on a lot covering 65,000 $m^2$ of covered surface, which has various installations.

The Complex has two lines for the procurement of uranium dioxide ($UO_2$):

1. The $UO_2$ production plant, totally integrated, with the nuclear purification sector using TBP [tributyl phosphate], developed and built by CNEA, and a $UO_2$ reduction furnace and related installations, supplied by RBU [Reaktor Brennelement Union GmbH] of the FRG.

2. The $UO_2$ production plant, entirely based on domestic technology, with the nuclear purification sector that uses amine-treated solvents, as part of a process patented by CNEA, and domestically produced reduction furnaces which are in the optimization phase.

The same building contains the headquarters of the Regional Center which carries out uranium mineral prospecting and exploration activities in the provinces Santiago del Estero, Cordoba, La Rioja, and San Luis.

The Concentrates Control Division operates independently, collecting, checking, and distributing the output of the uranium concentrate processing plants.

**Production of $UO_2$**

**I. Background**

Uranium dioxide ($UO_2$), the basic raw material for making nuclear fuels, is a material that is capable of producing elements with ceramic characteristics, that is to say, it is suitable for being compacted in the form of pellets and being sintered by means of heat treatment under a controlled atmosphere through two basic stages:
a) nuclear purifier;
b) conversion to $UO_2$.

Although the CFC has produced various compounds of nuclear purity starting in 1954, activities at the pilot plant and semi-industrial levels were initiated only recently at the beginning of the decade of the 1970's.

**II. Nuclear Purification**

Nuclear purity is achieved with the help of the treatment of commercial concentrates of uranium ("yellow cake").

After most of the impurities have been dissolved and eliminated, they are transformed into AUC [ammonium uranyl carbonate], a crystalline product with high purity, suitable for direct conversion (reduction) to $UO_2$; through direct compacting, this enables us to get pellets which, upon being sintered, assumes the density necessary for use as nuclear fuel.

AUC can also be obtained on the basis of two specific raw materials; for this purpose, the CFC uses two well-differentiated routes or lines:

1) Starting with a solution of UNH [uranium nitrate], obtained through separation of uranium with TBP [tributyl phosphate], concentration of 400 g U/L, and using a method of conventional precipitation with $CO_2$ and $NH_3$. This line is known as "AUC."

2) Starting with an organic medium, tertiary amine in kerosene, with hexavalant uranium fixed in the form of a sulfate-containing complex, using a simultaneous procedure of phase change and precipitation (precipitating elution). National Line known "AUTC" [ammonium uranyl tri-carbonate] or "TN" [National Technology].

The CFC developed the two nuclear purification lines, registering the second one as a patent of CNEA.

### III. Conversion to $UO_2$

Early in 1980, the CNEA, on the basis of its TBP Plant, decided to set up a $UO_2$ production plant with a sufficient capacity (150 t/year) for the supply of the nuclear power plants at Atucha I and Embalse; for this purpose it purchased the necessary conversion equipment from FRG's RBU. At the same time it continued to optimize the conversion furnaces based on national technology, so as to be able to put together a second plant with the AUTC line having a capacity similar to the preceding plant.

### Production of $UO_2$ Via AUC

### Engineering and Installation of Plant

The basic engineering of the integrated project was conceived by the Plant Engineering Department of the Nuclear Supplies Directorate, CNEA, after contact had been established with the installations of RBU at Hanau in the FRG in keeping with the conversion equipment module acquired from the latter as well as the nuclear purification installations using TBP which existed earlier in the CFC. The latter were designed and built by the same group at an earlier stage.

The layout is an independent sector for the nitric dissolution of the concentrate and the "aging" of silica.

The stages that involve the use of equipment supplied by RBU are:

—a nuclear purification sector using TBP, to which the solution of impure UNH is added, and out of which comes the concentration of 100 g

—a main building where the solution is concentrated to 400 g U/l [1], and then,

—in succession, units for crystallization (AUC), filtration, conversion to $UO_2$ and homogenization of the product.

Other main areas of the plant are the areas for the treatment of waste from the purification of concentrate ("B" waste) and evaporation, crystallization and filtration ("A" waste), the liquid and gaseous input systems, the service and utility buildings, the locker room area as well as the controlled access to the plant. The main building would allow for the installation of a possible second conversion module with a capacity similar to the existing one.

Progress in basic engineering, in terms of specifications for contracting, and all the way up to detailed engineering, was made by NMSE [Nuclear Mendoza Company of the State] with the technical management being supplied by CNEA. In most cases, the engineering job was turned over to specialized enterprises that supplied the various systems.

### Contract With Nuclear Mendoza S.E. [State Company]

The construction, equipment, and installation of the plant—except for the sectors previously available through CNEA (TBP and some buildings) and the supplies from RBU—were contracted for with NMSE through the at-cost system. The above-mentioned company had demonstrated its capacity during the construction of the mineral treatment plant involving leaching in basins in San Rafael (Mendoza).

The contract scheme reserved the general technical management of the project and the management of works activities to CNEA personnel temporarily assigned to NMSE while work inspection was carried out by the CFC. Most of the works, systems, and services are subcontracted out to private enterprises by NMSE. The contract with NMSE was signed on 17 January 1980. It facilitated an excellent technical-administrative relationship and the various portions of the entire project were completed in a smooth manner, without any break in continuity, in line with the annual available budget allocations and without any major interference.

At the end of the first stage, NMSE had awarded something like 200 subcontracts; the first stage was limited to civil engineering work, construction, equipment, and installation of main equipment units of the plant, assembly of nuclear purification section using TBP, installations for liquid and gaseous inputs, and completion of the production complex through the operation of 25 batches of the fluidized-bed furnace.

### a) Participation of Argentine Technology and Industry

The CNEA did the basic engineering for the project as a whole and, together with NMSE, it handled the detail engineering and the industrial architecture.

Except for the equipment acquired from RBU, which was imported directly by CNEA, all of these supplies and supporting services were contracted out to domestic enterprises which, in some cases, had to supply imported equipment and instruments that were a part of their deliveries.

The CNEA directly took care of the design, construction, equipment, installation, and final checkout of the TBP section and, together with RBU personnel, it also handled the assembly and final checkout of the equipment supplied by that German company. The rest of the activities were carried out in line with the contract signed with NMSE.

The main works, equipment items, installations, supporting services, and systems subcontracted in an independent form to Argentine enterprises are as follows:

- plant building featuring precast structures;
- finishing the main building;

- buildings for supporting services and concentrate dissolution;
- building for locker rooms and controlled access to the plant;
- paving of streets and perimeter walks;
- systems of sewers and drainage from the entire compound;
- steel structures for the installation of equipment for the conversion sector;
- concentrate dissolution installations (UNH);
- "A" and "B" waste installations;
- systems for compressing and extracting gases from the main building (-400 mm Hg) and pneumatic transport of dust (5,000 m C/water);
- demineralized water system;
- gaseous input systems ($CO_2$, ammonia, nitrogen, hydrogen);
- liquid input systems (nitric and sulfuric acid, methanol, fuels, etc.) as well as solid inputs;
- utilities (power, compressed air, steam, water, etc.);
- installation of press and sintered material furnace for characterization of $UO^1$[as published].

It is estimated that around 80 percent of the plant's total cost is accounted for by domestic participation.

**b) Nuclear Purification**

The attack of the concentrate, containing approximately 65 percent uranium, is accomplished with concentrated nitric acid. The solution thus obtained remains in the reactors until the aging of the silica. Partially diluted, the silica flakes are separated in a rotating filter with a "preliminary layer" of diatomaceous earth, giving us a solution of 300 g U/l after washing.

The solvent, which acts as "organic phase" during the extraction stage, consists of a solution of TBP in kerosene. The extraction stage is followed by an organic washing phase using a solution of UNH of nuclear purity. Finally, the re-extraction stage is carried out with demineralized water, made acidic with nitric acid. In these cases (extraction, washing, and re-extraction), we work with a countercurrent setup and with a continuous system.

The result of this process is a solution of UNH with a concentration of 100 g U/l, offering nuclear-grade purity. To be able to obtain crystals of AUC, we must increase this concentration to 400 g U/l; for this purpose we insert a stage for the evaporation of the diluted solution.

**c) Conversion to $UO_2$**

The solution of UNH with 400 g U/l is precipitated with carbonic anhydride ($CO_2$) and ammonia ($NH_3$) to obtain crystals of AUC. These crystals require a special morphology which is achieved through forced recirculation along with the reagents during the formation process.

The resultant suspension is filtered and the crystals are separated, washed with carbonated water and methanol, collected by means of suction, and transported in a pneumatic form all the way to the fluidized-bed conversion furnace. Conversion to $UO_2$ is accomplished in a reducing environment due to the presence of hydrogen; this causes the decomposition of AUC and the formation of powdered $UO_2$ which retains the earlier morphology, with an emission of $NH_3$ and $CO_2$. The powder thus obtained is stabilized in a container which is in the base of the furnace. Finally, various charges (operations) of the furnace are mixed in a rotating unit which ensures the homogeneity and uniform quality of the $UO_2$.

**d) Equipment**

The equipment units for this stage were supplied by RBU and comprise the following:

1. An assembly of three evaporation columns to increase the concentration of the solution of UNH from 100 g U/l to 400 g U/l with equipment for the absorption and washing of the gases generated during the operation.

2. A unit for the precipitation of AUC, consisting of a hermetic container cooled by water, with a forced recirculation system for the suspension of crystals, by means of pumping, which determines the morphology and size of the grain.

3. Two rotating vacuum filter units with a perforated horizontal circular plate, covered with cloth, with AUC washing systems, using water and methanol, and with pneumatic transport to the conversion furnace.

4. A furnace for the reduction of AUC to $UO_2$, featuring a fluidized bed in a hydrogen environment, heated electrically to temperatures of 550-650 °C, with systems for the supply of hydrogen, nitrogen, and water vapor, for the required final oxidation, cooling by means of water for the stabilization of $UO_2$, and checking and washing of emitted gases.

5. Two rotating tanks for the final homogenization of $UO_2$ in batches of 2,000 kg (approximately 10 batches of furnace output).

6. The systems for the automation, measurement, and checking of the flow of the operation of all of the previously mentioned equipment units.

7. Instruments: press and accessories for the procurement of pellets and sintering oven for the $UO_2$ characterization tests.

## Production of $UO_2$ Via AUTC

### Background

Studies relating to the production of AUTC have been pursued in various countries, either as a main product, as a byproduct, or simply mentioned as a secondary substance involved in a process.

However, the initial work in Argentina, which constituted the preliminary basis for the so-called national technology, consisted of the work started by E.G. Macchiaverna and J.C. Cadirola who tried to find an alternative for nuclear purification through AUTC. This work was done during the decade of 1960.

During the decade of 1970 and on the basis of the previously mentioned studies, work was done at the semi-industrial level; the studies that advanced this production line all the way to the manufacture of sinterizable $UO_2$ for nuclear power fuels were also continued.

### Description of Process

The uranium concentrate (coming from the concentration plants) is obtained in the form of diuranate of sodium or diuranate of ammonium. Right now, preferably in the second form, the concentrate has a grade of around 78 percent of $U_3O_8$ dry and a large quantity of other elements which, in various forms of combination, constitute the impurities of the concentrate.

### Dissolution of Concentrate

This concentrate is dissolved by means of the combination of sulfuric acid and water up to a concentration fluctuating around 80-100 g of uranium per liter and a solution pH close to 1.

The previously filtered concentrated solution is diluted with industrial water up to a concentration fluctuating between 10-30 g U/l, heated by means of steam up to a temperature of approximately 40 °C.

Under these conditions, it is introduced into an extraction battery of 5 stages in countercurrent where the first uranium purification process takes place. In this 5-stage assembly, the aqueous phase transfers UVI [as published] to the organic phase in a selective form. The organic phase is enriched in terms of uranium.

At the end of this first process of purification, we get a sterile aqueous phase with a content of less than 10 ppm which retains in it the major portion of the previously mentioned impurities. We thus get an organic phase charged with uranium which still contains some of the mentioned impurities in small portions (on the order of ppm) plus a considerable quantity of sulfate anion inherent in the process itself.

We must add that there is also a saturation stage for the organic phase which acts as a safety stage in an independent form after the purification stage. This operation is carried out in a battery made up of two stages where we get contact with a solution of uranyl sulfate offering nuclear purity with an approximate concentration of 20-40 g U/l. This operation guarantees a constant charge of the organic phase in terms of uranium in a form independent of what could happen in the prior operations; it also consequently ensures the reduction of impurities through displacement with respect to the saturation uranium.

The precipitating elution stage is of fundamental importance since, in addition to constituting an additional chemical purification phase, during which all impurities are reduced in a drastic form, including sulfate (the latter up to concentration of less than 100 ppm, according to the conditions provided), we also check in it the physical properties of the AUTC obtained, the shape (polycrystals or simple crystals), the geometric parameters (base—height ratio), the size, the size distribution (uniformity, greater proportion of fines, etc.), the apparent density (products of greater or lesser apparent density for one and the same size and distribution), and the mechanical strength (crystals of low or high resistance to fracture resulting from mechanical action or heat decomposition).

Conversion to $UO_2$ is accomplished then in tray ovens, in an atmosphere of dissociated ammonia and nitrogen at a temperature of 695 °C. The product successively goes through ammonia, nitrogen, and once again ammonia, dissociated for periods of 30, 20, and 30 minutes, respectively.

Finally, it is transported to a cooling zone leading to a temperature of 120 °C. After that it is passivated and homogenized for final packaging.

05058/08309

## INDIA

### Danger of PRC Selling Pakistan Nuclear Capability
*51500167 Bombay THE TIMES OF INDIA in English 5 Apr 88 p 8*

[Article by K. Subrahmanyam: "Chinese Missiles and Indian Security"]

[Text] On 18 March, the State Department spokesman, Mr Charles E. Redman, confirmed that the Saudis had admitted to the United States that they are buying CSS-2 class surface-to-surface missiles in their most advanced form with a range of about 2,200 miles. According to the U.S. spokesman, both China and Saudi Arabia have assured that the missiles will have only conventional warheads. The U.S. analysts have also persuaded themselves that this purchase was intended to enable Saudi Arabia to exert significantly greater influence in regional disputes. Some of the CSS-2 missiles are now currently deployed south of Riyadh.

Only last April (1987) seven Western countries led by the United States concluded an agreement not to transfer missile technology to developing countries. But Saudi Arabia, an American ally, had been negotiating (since 1985) the purchase of long-range CSS-2 missiles. Incidentally, the former director of CIA, Mr William Colby, was the registered lobbyist for Saudi Arabia in the United States.

Strangely enough the American spokesman has omitted to mention two significant facts. Saudi Arabia has not signed the non-proliferation treaty and it does not have diplomatic relations with China (at least it did not till recently). Also, while the Saudi-China negotiations are reported to have begun in 1985, the missile war between Iraq and Iran and the Iranian threat to Kuwait did not assume the present significance and intensity till early 1987. Therefore, it is legitimate to inquire how and in what circumstances this sale has come about.

#### Jigsaw Puzzle

Some parts of the jigsaw puzzle fall into place if one were to remember the reports emanating from the U.S. intelligence community in 1984-85 that China gave Pakistan its design of the nuclear warhead which it had used in its fourth test and that there were reasons to suspect that the Chinese conducted one of Pakistani nuclear tests at their Lop Nor site. No country could have been a more natural intermediary between China and Saudi Arabia than Pakistan which has close relations with both. That in turn raises the question that, even if China does not supply nuclear warheads to the Saudis, Pakistan can.

Writing in NEW YORK TIMES magazine of 6 March 1988, Mr Heobick Smith says: "American experts believe that Pakistanis do not need to test an actual bomb. Sometime during the early 1980's, they say, the Chinese gave the Pakistanis a reliable, tested bomb design, in exchange for Pakistan's sharing its modern uranium-enriching technology. During the last several years Chinese scientists have reportedly visited or worked off and on at Pakistan's Kahuta facility. The Chinese design, American officials say, enables Pakistan to produce a much more sophisticated atomic bomb than the crude five-ton weapon dropped on Hiroshima. American officials estimate that, while India can make a bomb weighing less than a ton, Pakistan can make one weighing less than 400 pounds."

The Chinese SS-2, according to the MILITARY BALANCE 1987-88, is meant to carry a two-megaton warhead. According to SIPRI Year Book 1987, the Chinese were reported to have a stockpile of only 85-125 and the MILITARY BALANCE 1987-88 puts it at 60. One is entitled to doubt the veracity of these figures since a country which has only 60 or 80-125 missiles will hardly start exporting them. And what sense does it make for Saudi Arabia to buy some 10-12 missiles with conventional warheads?

#### Arms Market

The Chinese denied selling Silkworm missiles to Iran. Recently during his visit to London, the Chinese foreign minister said that the arms market was a very complicated one and therefore it was not possible for China to say whether the countries to whom China sold its Silkworm missiles had not transferred them to Iran. On the other hand, the Americans claim they have satellite photographs of Chinese Silkworm missiles being loaded on particular ships and being unloaded in Iran from the same ships.

For an Indian the legitimate question is: If China was prepared to sell CSS-2 missiles to Saudi Arabia will there be any hesitation on its part to transfer CSS-2 to Pakistan as well? Some of our commentators have been emphasising that Pakistan lacks a delivery system. The Chinese could meet this need.

This writer has always held that the Pakistani nuclear vision was not restricted to India. Ultimately Pakistan will attempt to exercise influence in West Asia and South-west Asia. If one reads in the U.S. State Department spokesman's statement the reference Saudi Arabia as applying to Pakistan and Pakistan as well, one would not be wide of the mark. The two together would like to exert significantly greater influence in regional disputes ranging from the Gulf war to Arab-Israeli conflicts. Pakistan already has a small missile programme in its SUPARCO establishment. There is no reason to exclude possible Chinese transfer of CSS-2 missile technology to Pakistan.

#### Soviet Decision

The Soviets have decided to withdraw from Afghanistan whether there is an agreement or not in Geneva. This may make at least some U.S. Congressmen raise questions regarding further arms supplies to Pakistan. Pakistan may still be in a position to exercise leverage over

U.S. Congress—just as Israel does—by arguing that, if the United States does not continue its arms supplies, it will be compelled to unveil its nuclear capability. In addition, both China and the United States may share a common objective in strengthening an Islamic nuclear capability not vis-a-vis Israel but vis-a-vis the Soviet Union where there has been political unrest in Azerbaijan, Uzbekistan and other Islamic republics.

One side-effect—not anticipated by the United States—may be that the combined Saudi-Pakistani nuclear capability may put limits on what Israel can do vis-a-vis its neighbours and raise the morale of the Palestinians. The Israelis are already worried about the missile capabilities of Iraq and Syria and the reported acquisition of chemical weapons by these countries. The Iraqi possession of chemical weapons has also been no secret since it has already been used against Iran.

These developments highlight the need for India to expedite its own missile programmes. One has to weigh the consequences to our national security, if Pakistani nuclear capability gets unveiled along with the possession of the Chinese CSS-2 missile. It is enfortunate that we are still squabbling over a missile range site. No doubt, those who are to be displaced should be compensated adequately. If still it is difficult to locate the range site at Balasore, an alternative site should be quickly found. Hundreds of crores of rupees will be spent on a missile range and thousands of jobs will be created. So the local people should normally welcome it.

Meanwhile, we may have to explore the possibility of getting some SS-20 missiles without nuclear warheads from the Soviet Union. The Americans can verify to their satisfaction that the Soviet Union no longer possesses those SS-20s. If the United States can accommodate the Saudi, it can have no moral justification in objecting to India getting some SS-20s which are marked for scrapping under the INF treaty.

/9604

## AEC Chairman Gives Details of Soviet Reactors

*51500169 Bombay THE TIMES OF INDIA in English 17 Apr 88 p 9*

[Article by S. Kumar]

[Text] Bombay, 16 Apr—A draft inter-governmental agreement on the purchase of two 1,000 MW nuclear power reactors from the Soviet Union is awaiting cabinet approval, which is likely to be given within the next few weeks.

Dr M.R. Srinivasan, chairman of the Atomic Energy Commission, who led a team to the Soviet Union last w..., returned here yesterday after visiting the power plants and the largest nuclear manufacturing facilities of the USSR.

After the agreement is signed the first 1,000 MW unit is expected to be commissioned within 8 to 9 years. The second unit would be commissioned a year later, Dr Srinivasan told THE TIMES OF INDIA here today.

The department has made its recommendations to the government on the siting of the Soviet reactors. The actual cost of the power station will depend on the site.

### Loan for Project

However, the Soviet Union has agreed to lend up to Rs 3,000 crores towards the installation of the two units in India. This is believed to be the biggest sum of financial aid obtained by India for a single project.

Dr Srinivasan said that the price of power produced from the Soviet reactors would be comparable to the cost of power produced from indigenous nuclear power plants. The Soviet Union will offer a 20-year-term loan, at a rate of interest of 2.5 percent per annum.

The Soviet Union has agreed to the Indian condition that "full-scope international safeguards" will not be allowed, which means that only the Soviet reactors and the materials used in the reactor will be open for international inspection.

Under the full-scope safeguards, all nuclear installations, including the ones having no foreign component, are amenable for inspection.

### No Indigenisation

The project will be completed on a turnkey basis and India has taken a conscientious decision not to incorporate any indigenous component in the Soviet reactors. Indigenisation would mean delay. Also, Indian industry would have to be fully geared to meet the needs of indigenous power plants, leaving little scope for other efforts.

The two Soviet units will create employment for at least 2,000 operation and maintenance personnel. Though Soviet Union will bring its own components and special equipment for constructing the power plants, the actual construction jobs will be given to Indian construction companies.

The Soviet reactors will have to be set up on a coastal site since the heavy cranes and huge reactor components can be transported only by sea. The Soviet Union has adopted highly mechanised construction techniques. For example, the crucial reactor building will be constructed with pre-fabricated elements.

Dr Srinivasan allayed fears that importing Soviet units would hit indigenous efforts. The government would provide funds to all the indigenous nuclear power plants

as envisaged and no funds would be diverted to procure the Soviet units, he said. The Soviet units would not "substitute" but only "supplement" Indian plants, he added.

The cabinet will shortly approve 10 new 235 MW and six 500 MW indigenous units. Already 10 indigenous nuclear power units are under construction. In 1991-92, six more such 500 MW units are likely to be approved.

Maharashtra and Tamil Nadu are among the two candidate-states for the Soviet reactors. While Tarapur lends itself as a suitable site because of its existing infrastructural facilities the southern region also needs a stable source of power as it is increasingly becoming dependent on hydel power, leading to erratic power supply.

/9604

## West German Firm Offers Collaboration in Nuclear Power

*51590170 Calcutta THE STATESMAN in English 25 Mar 88 p 13*

[Article by Aditi Roy Ghatak]

[Text] "We are happy to confirm that Siemens/KWU have offered to the Department of Atomic Energy collaboration in the field of nuclear power plants", the Siemens India managing director, Mr A. Hoser, told this correspondent on Thursday. He was referring to reports that West Germany has offered its state-of-the-art technology for a 1,000 MW nuclear power plant, manufactured by KWU, a wholly-owned subsidiary of Siemens AG, West Germany.

The KWU, international leaders in power technology, has had a longstanding technical collaboration with the public sector, BHEL, but though nuclear power is an area of special strength for the company, it has steered clear of any collaborations on nuclear technology. A senior KWU source had hinted to this correspondent in February this year that nuclear power collaborations with India had not been considered so far in view of India not having signed the nuclear non-proliferation treaty.

The reported KWU offer of its Pressurized Water Reactor technology to India's Nuclear Power Corporation, therefore, gives rise to interesting questions about West Germany's attitude to the sharing of nuclear power technology—even for peaceful purposes—with countries that are not signatories to the nuclear non-proliferation treaty.

Replying to a question on this matter, Mr Hoser said, "It is correct to assume that collaborations in the field of nuclear power plant technology between Germany and other countries are easier when both countries have signed the NPT. But, as has been demonstrated by Siemens/KWU in the case of Brazil, it is also possible between Germany and a country which has not signed the treaty. In such cases, bilateral agreements between the Government of the partner-country and the Government of Germany, will solve the problem"

This evidently means that Government-level talks have taken place to pave the way for a possible KWU-Nuclear Power Corporation tie-up. The other serious contender for nuclear power plants in India is the Soviet Union. The Germans have repeatedly emphasized the high status in safety standards that KWU technology enjoys—a line not hard to sell after the Chernobyl accident. Moreover, the West German offer reportedly comes in an attractive financial package and also leaves considerable scope for indigenous manufacture.

/06662

## Accident at Baroda Heavy Water Plant Termed Minor

*51500166 Madras THE HINDU in English 2 Apr 88 p 7*

[Text] Bombay, 1 Apr—The damage to the heavy water plant at Baroda is not major and engineers and technicians are working round the clock to put the plant back into operation within 2 months time, Mr S.M. Sundaram, chairman and chief executive in charge of heavy water projects has told THE HINDU. In April 1986, the Talcher heavy water plant was affected by a fire similar to this one, though that was a major event.

Mr Sundaram said it could not be compared to the explosion which took place some 10 years ago at this plant. That was a major setback and took a long time to rectify. The plant was built by a consortium of two French and one Swiss companies. The collaborators bore the entire responsibility for repairing it.

### Post Haste at the Spot

Mr Sundaram said after the present explosion experts lost no time in reaching the spot from Bombay. In fact they travelled without ticket on the Rajdhani Express with the permission of the authorities to reach the site as quickly as possible. The explosion occurred at 12:35 pm on 18 March. They were on the spot by 9:00 pm.

The Baroda heavy water plant is the only plant which operates at a pressure of 600 atmospheres, since the fertilizer plant to which it is attached is being operated at this pressure. Other plants using this technology operate at much lower synthesis gas pressures, about 200 atmospheres since the fertilizer plants to which they are attached operate at this pressure. For example the two heavy water units at Thal are operating at 200 atmospheres.

Even 15 minutes before the explosion the usual routine check was carried out and everything was found normal. The explosion took place in between two pipelines and it destroyed all cables, linings etc.

**Due for Shutdown**

The unit which was producing 45 tonnes annually was shut down periodically. In fact, it was to be shut down in April/May this year.

The explosion occurred during the lunch interval and the fire lasted for one hour. It was contained during the time. There are automatic devices which would shut off the plant automatically whenever there is any accident. Normally, whenever there is any drop in the pressure, it takes 3 days for the plant to return to normal pressure. It is a continuous process. Fires in chemical plants are quite common.

**Probe Set Up**

An inquiry commission had been set up under the chairmanship of Mr Charan Das of the Gujarat State Fertilizer Corporation into the cause of the explosion.

Engineers are taking samples of the carbon steel components to gauge how much damage was caused. There are 500 to 600 samples to be examined. No sabotage is suspected. The life of the plant, which employs 400 people, is 20 years. The authorities are confident that it will complete its normal life. Besides Baroda, there are plants at Kota, Talcher Tuticorin, Thal, Hazira (to be commissioned shortly) and Manguru in Andhra Pradesh. Work at Manguru is going to be taken shortly.

Canada is the only other country to produce heavy water. All the other countries producing nuclear power use pressurised tubes. France, a major nuclear power, never uses heavy water.

After completing the Baroda plant, Indian scientists developed indigenous technology as knowhow is difficult to obtain since those possessing it are reluctant to part with it. The imported content is only 20 percent, as getting spare parts from other countries is difficult because vital spares are withheld once it is known that they are intended for heavy water plants.

/9604

## Atomic Power Official Tells Future Plans

*51500168 Bombay THE TIMES OF INDIA in English 18 Apr 88 p 15*

[Text] Pune, 17 Apr—India will set up six more 500-MW units in its different nuclear power plants in 2 years, taking the number of such units to 12, according to the managing director of the Nuclear Power Corporation, Mr S.L. Kati.

Mr Kati was receiving the "Calandaria," a critical equipment for use in the Rs 725-crore Kaiga atomic power project near Karwar in Karnataka, from the Walchandnagar Industries Ltd., at Walchandnagar near here yesterday. This was the fifth such equipment manufactured at Walchandnagar.

He said the projected power demand by the year 2000 would be 100,000-120,000 MW against the current availability of 51,000 MW.

Mr Kati said with the 90 percent indigenous content in design, equipment manufacture, erection and commissioning of power projects, their gestation period had been reduced considerably. There was an adequate indigenous production and supply of heavy water also, he said.

The managing director of the Walchandnagar Industries Ltd., Mr Chakor L. Doshi, said the company's association with the country's nuclear power projects was long beginning with the first indigenous plant in Rajasthan.

/9604

## EXPRESS Calls for End to Nuclear Expansion

*BK2505103888 Delhi INDIAN EXPRESS in English 17 May 88 p 8*

[Editorial: "Nuclear Power Secrets"]

[Text] Although the government has denied the recent allegation, made in a Norwegian newspaper report, that 15 tonnes of radioactive heavy water shipped from Norway to a West German enterprise in 1983 was diverted to India through Switzerland and Dubai, it must still explain how India has met its heavy water requirements. Despite its efforts to restrict information on the country's nuclear power programme, some of the facts have emerged through the reports of the Comptroller and Auditor general [CAG]. These reveal several significant facts which have a bearing on the suspicion that India may have tried to bypass international regulations which prohibit countries like Norway, Canada and the Soviet Union from supplying to countries like India which do not accept fullscope international inspection of their nuclear facilities.

The CAG report on the Tuticorin heavy water plant, which was commissioned in 1978, reveals that it has functioned at only 20.6 percent of its installed capacity in the last eight years. Production losses amount to a staggering Rs 123.97 crore and the plant, which produces 60 percent of the country's heavy water requirements, operated on only 1,284 days against 2,550 available days. The record of the Talcher heavy water plant is even worse; in 12 years it has produced virtually nothing. The fact that indigenous supplies of heavy water have not sufficed is also evident from the CAG report on the Madras Atomic Power Plant at Kalpakkam, that the delay in its commissioning was due to a shortage of

heavy water. The government has also now admitted that it had to import heavy water from the Soviet Union for the Rajasthan Atomic Power Plant, one of whose units has had to be permanently shut down due to an irreparable crack in its end-shield.

It is clear from these and other facts that India is in no position to meet its requirements of heavy water if it is to pursue its goal of increasing the installed capacity from the present 1,250 MW to an incredible 10,000 MW by 2000 AD. Therefore, the Prime Minister's statement that India is self-sufficient in heavy water is fallacious. The CAG reports also reiterate a fact now acknowledged in many countries, that the economics of nuclear power are not really attractive. This is especially true in India where interminable delays and low production make the unit cost of nuclear power uneconomic. As important are the safety aspects on which there is little reason for confidence in Indian reactors. The government must therefore explain on what grounds it is continuing to pursue nuclear power plans when so many factors militate against further expansion.

## MOROCCO

### Nuclear Power Station Projected for Jorf Lasfar

*51004603 Casablanca LA VIE ECONOMIQUE in French 18 Mar 88 p 12*

[Text] In an interview granted to the international periodical TIJARIS (published by the CIDC), Mohamed Fettah, minister of energy and mines, provided interesting details on the Moroccan nuclear power program.

Why was the nuclear option chosen? In answer to this question, Fettah said that "nuclear power is a viable alternative in limiting Morocco's dependency on imported fossil fuels and meeting the nation's long-term electric power needs."

Studies on meeting the demand for electricity show, the minister added, that the nation's identified potential in primary, hydraulic and coal energy will scarcely exceed 6 to 8 billion kWh, while the need for electricity will total 18 billion kWh by the year 2000. "In other words," he said, "if no new source of primary energy is used to produce electricity by the year 2000, imported fuel would have to be used to produce some 14 billion kWh."

The minister said that confronted with this situation, a national nuclear power program was instituted in 1980, integrating the activities of the country's different socioeconomic sectors.

Within this framework, he said, the year 1984 witnessed the launching by the National Electricity Office (ONE) of a technical and economic feasibility study and the choice of the site for the first nuclear power plant. He added that the study will make it possible by the end of 1988 to have the elements needed to make decisions and draft calls for bids for the nuclear power plant. A reference site and a reserve site have already been selected. Research and construction are under way at the reference site in connection with its qualification and confirmation.

The minister reported that the department, working with the International Atomic Energy Agency (IAEA), has initiated a program of action involving the drafting of national nuclear power regulations and the establishment of a regulatory body to oversee nuclear activities at the national level and to hire and train personnel in nuclear sciences and techniques.

A bill relating to the establishment of a National Nuclear Energy, Sciences and Techniques Center (CNESTEN) was passed in 1986. The center will house a research reactor and provide technical and scientific support, particularly in the areas of training, research, safety and nuclear control and permit the production of nuclear techniques in the vital sectors of the national economy. Studies on site selection and construction of the CNESTEN have been entrusted to the National Electricity Office (ONE).

**Uranium Mining Tests**

Regarding the nuclear fuel cycle, he said that Morocco has a major asset: the availability of uranium linked with phosphates. For several years now, the Moroccan Phosphate Office has been at work on studies involving uranium mining at phosphoric acid plants in Safi at Jorf Lasfar. The Mineral Phosphates Research Center (CERPHOS) is engaged in several laboratory tests on a pilot basis.

**Thermal and Hydraulic Prospects**

Turning to prospects of thermic and hydraulic energy, the minister said that in medium-range terms, they correspond to the program to be carried out during the 1988-1992 5-Year Plan. Those prospects include:

Thermal energy: A 600-megawatt plant will be built in two phases at the Jorf Lasfar site and be able to use coal or fuel. Plans also exist for two 100-megawatt gas turbines to meet the demand, particularly at peak hours. One turbine will be set up at Mohammedia and the other at Tan-Tan. Finally, a 21-megawatt diesel power plant is being built at Laayoune. Hydraulic power: construction of the Matmata plant (240 megawatts in three generators), the Dchar-El-Oued/Ait Messaoud complex (1 X 92 megawatts plus 3 X 2.8 megawatts) and, in the future, M'jara (3 X 80 megawatts).

Completion of this minimum hydraulic program (584 megawatts) will result, the minister said, in a savings of 230,000 tons of fuel a year. The minimum program will be joined by a project of lesser importance associated with the Sidi Driss dam, already completed.

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## IRELAND

### Energy Minister Fights UK Nuclear Waste Plan

*51500165 Dublin IRISH INDEPENDENT in English 4 Apr 88 p 3*

[Article by Gene McKenna]

[Text] Energy Minister Ray Burke said yesterday he will continue to strongly oppose any plans by Britain to store its stockpile of radioactive waste under the Irish Sea.

He was commenting on reports that British Nuclear Fuels Ltd.—operators of the controversial Sellafield nuclear stations—have applied to Cumbria county council for planning permission to drill a bore-hole inside the boundary fence at Sellafield to see if their plans for sub-sea stockpiling are feasible.

Mr Burke said he already as made his views on the whole matter very clear to his UK counterpart, Mr Cecil Parkinson.

"I have told Mr Parkinson about the strength of feeling in this country on the issue, and my views are well known on it," added the minister. "We have enough problems here without something like this further exacerbating the situation."

As far as he knew, a number of sites were still being looked at by the British authorities for the disposal of radioactive waste.

As well as protests from Mr Burke, there also has been opposition to the plan to dump at sea from conservationists on both sides of the Irish Sea.

Last night, a spokesman for NIREX, the British body responsible for disposal of nuclear waste, said the Irish Government's view would be taken into account when considering proposals to dispose of radioactive waste.

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## TURKEY

### TAEC Has 'Nuclear Emergency Plan' in Progress

*51002446 Istanbul TERCUMAN in Turkish 20 Mar 88 p 6*

[Article by Emin Pazarci: "Chernobyl Taught Us Lesson"]

[Text] Ankara—[TERCUMAN] First, the Chernobyl accident contaminated everything through radiation fallout—from our hazelnuts and tea to our water and bread—and now it has raised Turkey to a new level of awareness. Heeding the lesson of the Chernobyl disaster, plans have been set in motion to produce a state of readiness in the possible event of a similar catastrophe. The Turkish Atomic Energy Commission (TAEC) has begun to prepare "Nuclear Disaster Guidelines" for all types of nuclear hazards that might endanger Turkey.

The objective is, first of all, to make a written record of the location and types of all nuclear installations abroad and in neighboring countries, as well as their security guidelines. Second, "Nuclear State of Emergency Plans" will subsequently be prepared to provide various detailed projections of the effects on the nation of Chernobyl-type accidents, arranged according to degree of severity, and action plans will be developed for necessary measures appropriate to each level.

#### Nuclear Disaster Chief

For the purpose of shielding the country as much as possible from the damages of nuclear accidents, first, a "Nuclear Disaster Headquarters" will be formed within TAEC to oversee operations called for by the "Nuclear Disaster Guidelines," and coordination of the activities designed to meet an emergency will be directed by the Headquarters.

Answerable to the Nuclear Disaster Headquarters, the nuclear security advisors will be selected from radiation protection and field control personnel. Moreover, units formed from the police and military forces will be established to be ready to continually monitor water sources, agricultural, and fresh and salt water products during a nuclear disaster. Hospitals and meteorological stations to be used in a disaster will be designated in advance.

#### What To Do in Which Situation?

For use in the event of a serious nuclear accident, detailed maps will be drawn of residential centers and their evacuation routes, and photographs will be taken of each region. The location of stations to test radiation levels during a disaster will be determined. Written guidelines for decision-making during a disaster will spell out, according to the radiation level, which action should be taken. In the future, provision for safety shelters will be required in new buildings.

During a nuclear accident, decisions will be transmitted to the "Disaster Coordination and Administration Center." To reduce the disaster to its smallest proportions, "Active Disaster Intervention Units," an "Evacuee Collection Center," a "Public Information Center," a "Disaster Radiology Laboratory" and "Sampling and Control Units" will be in continuous operation. Hospitals to treat people exposed to radiation will be equipped with the necessary apparatus. A directory of the names, addresses and telephone numbers of personnel assigned for duty in the event of a disaster will be prepared, and arrangements will be made for their transport to their stations during a disaster.

**General State of Emergency**

When necessary, the Nuclear State of Emergency Guidelines may be used in the event of a natural or other disaster. Execution on a nationwide scale, however, will require the active participation of a great many agencies. For this purpose, shelter capacity throughout the country will be determined, and an infrastructure will be created to oversee control of entrance and exist checkpoints in urban areas.

It will also be necessary to determine the dosage and distribution schedule of the iodine tablets to be used in the event of a leak of nuclear radiation, to improve the lines of communication for evacuation, to train personnel for medical assistance, and to prepare educational programs to inform the public.

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